Uropathogenic bacterial profile in Hemodialysis Patients with Renal Failure Attending the Dialysis Unit in Ramadi city, Iraq

Wassan Shaker Ajami & Haidar Kadum Yakob

Department of Biology, College of Education for Pure Sciences, University Of Anbar, Iraq
halsalamany@uoanbar.edu.iq

Abstract:

This research aimed to isolate and identify of some bacterial species from renal failure patients undergoing dialysis treatment in the dialysis unit at dialysis unit in Ramadi city, by collecting and diagnosing pathogenic bacteria before and after dialysis sessions. Urine samples (160) were collected from (80) patients (one before and after washing), and the samples were cultured on differential culture media, isolates were activated and purified, then final diagnosis using the VITEK 2 COMPACT device. The results showed that females constituted the largest percentage of the sample, and that most of the patients belong to the age groups (51-60) and (61-70) years. The data also showed that kidney failure, alone or in combination with other chronic diseases, was the most common among comorbidities. In terms of bacterial isolates, Gram-negative bacteria, especially *Escherichia coli*, *Pseudomonas aeruginosa.*, and *Klebsiella pneumoniae*, with a marked change in the pattern of isolates after dialysis, indicating the effect of the process on the nature of bacterial colonization. Therefore, the research recommends the importance of routine screening of urine isolates in dialysis patients, adherence to sterilization and infection control procedures, as well as promoting the use of advanced diagnostic methods.

Keywords: Urinary tract infection, hemodialysis unit, renal failure, infectious bacteria, Ramadi city.

الانواع البكتيرية الممرضة للجهاز البولي لدى مرضى الفشل الكلوي الخاضعين للغسيل الكلوي في وحدة الغسيل الكلوي بمدينة الرمادي، العراق

وسن شاكر عجمي

أ. د حيدر كاظم يعقوب

قسم علوم الحياة، كلية التربية للعلوم الصرفة، جامعة الأنبار، العراق

halsalamany@uoanbar.edu.iq

الملخص:

هدف هذا البحث إلى عزل وتشخيص بعض الأنواع البكتيرية لدى مرضى الفشل الكلوي الخاضعين للعلاج بالغسيل الكلوي في وحدة الغسيل الكلوي بمدينة الرمادي، وذلك من خلال جمع وتشخيص البكتيريا الممرضة قبل وبعد جلسات الغسيل. تم جمع (١٦٠) عينة بول من (٨٠) مريضًا (عينة واحدة قبل وأخرى بعد جلسة الغسيل)، وزُرعت العينات على أوساط زرعية تفريقية، ثم تم تنشيط وتنقية العزلات، وأُجري التشخيص النهائي باستخدام جهاز VITEK 2 COMPACT.

أظهرت النتائج أن الإناث شكّلن النسبة الأكبر من العينة، وأن معظم المرضى ينتمون إلى الفئتين العمريتين (٥١–٦٠) و(٦١–٧٠) عامًا. كما أظهرت البيانات أن الفشل الكلوي، سواء كان منفردًا أو متزامنًا مع أمراض مزمنة أخرى، كان الأكثر شيوعًا بين الحالات المصاحبة.

أما من حيث العزلات البكتيرية، فقد سادت البكتيريا سالبة الجرام، لا سيما الإشريكية القولونية(Escherichia coli)، والزوائف الزنجارية(Pseudomonas aeruginosa) ، والكلبسيلة الرئوية (Klebsiella) pneumoniae)، مع ملاحظة تغير واضح في نمط العزلات بعد الغسيل، مما يشير إلى تأثير عملية الغسيل الكلوي على طبيعة استعمار البكتيريا.

وبناءً على ذلك، يوصي البحث بأهمية الفحص الروتيني لعزلات البول لدى مرضى الغسيل الكلوي، والالتزام بإجراءات التعقيم ومكافحة العدوى، إضافة إلى تعزيز استخدام الأساليب التشخيصية المتقدمة.

الكلمات المفتاحية: التهاب المسالك البولية، وحدة الغسيل الكلوي، الفشل الكلوي، البكتيريا الممرضة، مدينة الرمادي.

Introduction

Kidney failure is one of the most serious health problems in the world, and advances in treatment technologies have led to the adoption of dialysis as one of the most life-saving medical interventions for thousands of patients around the world (Jha et al., 2020). However, continued reliance on dialysis machines makes these patients moresusceptible to bacterial infections, which are the most common and serious complications in dialysis units (Kliger, 2017; Kang et al., 2019), WHO reports that infection in dialysis patients is associated with high rates of morbidity and complications, especially in countries with declining health infrastructure or lack of continuous microbial surveillance (WHO, 2019). In this context, accurate diagnosis of infectious bacterial agents is of great importance in the early detection and prevention of pathogenic microbes within washing units, especially with increasing reports of outbreaks of infections associated with clinical procedures (Zhang et al., 2018) , Approved diagnostic methods include bacterial isolation using conventional culture on selective and differential media such as MacConkey agar and Blood agar, enabling initial differentiation between bacterial species according to their morphological characteristics and growth

(Collee et al., 2020; Cheesbrough, 2017). Reliance on private media also allows the detection of microisolates that may be neglected in general implantation techniques, and enables the degree of contamination or colonization to be analyzed in clinical samples (Forbes et al., 2019) , Recent years have seen an evolution in rapid and accurate bacterial diagnostic techniques, most notably the VITEK 2 system, which relies on automatic biochemical pattern analysis technology and provides accurate and reliable results within a few hours (Funke & Funke-Kissling, 2015; Patel, 2019). The phytic device is one of the internationally approved devices in modern microbiology laboratories, due to its speed in identifying bacterial species with high accuracy of up to 95-99% compared to traditional methods (Delmas et al., 2022) ,In Iraq, with the growing number of patients with kidney failure, dialysis units are a critical environment that requires careful monitoring of the pathogens prevalent in them, especially in light of the epidemiological and service conditions that the country has gone through in recent years (Al-Mayah et al., 2020; Mahmood et al., 2021). Local studies show high rates of bacterial colonization in patients visiting washing units, but there is variation in the type of isolation depending on the geographical location and health level of the medical institution (Yaseen et al., 2021).

Hence, the importance of this research stems from the fact that it aimed to isolate and diagnose pathogenic bacteria from patients attending the dialysis unit in Ramadi city using accurate microculture methods, followed by diagnostic techniques using specific media and the VITEK 2 device to identify bacterial species causing infection. Through this work, the researcher hopes to contribute to building an accurate local database on bacterial patterns circulating in the dialysis center in Ramadi., which is an initial step towards strengthening laboratory surveillance and preventive measures in local health institutions.

Materials and Methods

Study site and samples

This research was conducted in the dialysis unit in Ramadi district, Anbar Governorate, Iraq, and targeted chronic renal failure patients undergoing dialysis sessions. The number of participants in the study reached (80) patients, and two urine samples were collected for each patient: the first sample before the start of the washing session, and the second immediately after its end, for a total number of samples to 160 urine samples.

The samples were collected using sterile 50ml urine cans, in accordance with approved clinical standards to ensure the safety of the samples and prevent contamination.

Transplantation and isolation steps

Urine samples were transplanted immediately after arrival to the laboratory on plates containing a blood agar and MacConkey agar, following a linear surface pollination technique (Streak plate method), and then the dishes were incubated in an incubator at 37°C for 24 hours. After bacterial growth appeared on blood agar dishes, the developing colonies were transferred to MacConkey agar to identify Gram-negative bacteria and differentiate between fermented and unfermented lactose isolates, and then re-incubated at 37°C for 24 hours.

Pure colonies were selected from each isolation and were diagnosed using VITEK 2 COMPACT device (BioMérieux – France), which is based on the automatic analysis of biochemical properties.

Results and Discussion

Urine samples were collected from (80) patients who visit the dialysis unit at Ramadi city, where two samples were taken from each patient: one before the start of the dialysis session, and the other immediately after, for a total of (160 samples). The patients were listed based on their clinical data (gender, age group, comorbidities), as shown in the following table:

Table (1) Distribution of Patients by sex, age, and comorbidities

Sex					
Female		male			
Percentage	No.	Percentage	No.		
3.75%	3	0.00%	0	Less than 10	Age
3.75%	3	5.00%	4	11-20	
5.00%	4	3.75%	3	21 - 30	
11.25%	9	1.25%	1	31 - 40	
2.50%	2	6.25%	5	41 - 50	
16.25%	13	13.75%	11	51 - 60	
10.00%	8	10.00%	8	61 - 70	
6.25%	5	0.00%	0	71 - 80	
1.25%	1	0.00%	0	80 and more	

60.00%	48	40.00%	32	Total	
8.75%	7	6.25%	5	Pressure + sugar	**Diseases**
20.00%	16	7.50%	6	Kidney failure	
0.00%	0	8.75%	7	There isn't any	
1.25%	1	0.00%	0	Blockage of an artery and pressure	
3.75%	3	2.50%	2	Pressure, sugar and kidney failure	
0.00%	0	1.25%	1	Enlarged liver	
1.25%	1	0.00%	0	Stroke and kidney failure	
1.25%	1	0.00%	0	Bone marrow cancer and kidney failure	
1.25%	1	1.25%	1	Diabetes and kidney failure	
6.25%	5	1.25%	1	Compression + kidney failure	
7.50%	6	6.25%	5	pressure	
0.00%	0	1.25%	1	Pressure and heart failure and kidney failure	
1.25%	1	1.25%	1	Pressure, heart and sugar	
0.00%	0	1.25%	1	Atrophy and renal failure	
2.50%	2	0.00%	0	Heart failure + kidney failure	
1.25%	1	0.00%	0	Heart failure and pressure	
0.00%	0	1.25%	1	Heart + water in the chest	
1.25%	1	0.00%	0	Kidney failure + kidney atrophy + pressure	
1.25%	1	0.00%	0	Heart, pressure and blockage of an artery	
1.25%	1	0.00%	0	Hereditary anemia	
60.00%	48	40.00%	32	Total	

Distribution by sex

Data indicate that females constituted the largest percentage of the sample (60%) compared to males (40%). This distribution is consistent with some regional studies such as Khan et al., 2020, which showed a higher percentage of dialysis unit visits than females due to their high rates of diabetes and chronic pressure, which are the most prominent causes of kidney failure , However, other studies, such as Al-Ali et al., 2021, have shown a slight outlook in the proportion of males in dialysis units, due to the nature of physical activity, exposure to work hazards,

and medications, indicating demographic variation associated with demographic and social factors.

Distribution by age group

The results showed that the highest percentage of patients was within the ages (51-60) and (61-70) for both males and females, by (26.25%) of the sample. This is consistent with the results of a study (Nasr et al., 2022), which showed that chronic renal failure is common in older ages, as a result of the gradual accumulation of chronic diseases such as diabetes and hypertension.

It is noteworthy that the percentage of cases in the group (31-40 years in females was higher than males (11.25% versus 1.25%), an indicator that may be associated with hormonal factors, or delayed diagnosis of chronic diseases in women, as indicated by a study (Fitzpatrick et al., 2021). In contrast, age groups under 20 years recorded limited percentages (less than 10%), reflecting the low prevalence of kidney failure at these ages, an observation confirmed by a global study (Jha et al., 2020).

Comorbidities

The results of the patients showed that chronic renal failure alone or associated with other chronic diseases (diabetes, pressure, heart) constituted the largest percentage among the pathological causes, especially among females (20%) compared to males (7.5%). These findings confirm a study (Liyanage et al., 2015) that indicated that chronic diseases such as diabetes and hypertension constitute 70% of the causes of kidney failure globally. Some complex medical conditions such as "pressure + kidney failure + heart failure" or "bone marrow cancer" have also appeared, which are rare but clinically significant and indicate multiple deterioration of the body systems. It is worth noting that some males did not have obvious diseases (8.75%), which may indicate the presence of kidney failure cases with undiagnosed or delayed causes, which was alerted by a study (Wang et al., 2019), which showed that about 15% of kidney failure cases occur without traditional risk factors.

Bacteria isolated before and after dialysis

Urinary infection-causing bacteria were isolated and diagnosed from patient samples using differential media bacterial culture and instrumental diagnosis with

the VITEK 2 device, before and after each patient's dialysis session. The results showed a clear diversity in bacterial isolates between the two samples, as shown in the following table:

Table (2) Number and percentage of isolated bacteria.

After washing		Before washing		Type of bacteria
Percentage	No.	Percentage	No.	
35.00%	28	30.00%	24	***E. coli***
36.25%	29	28.75%	23	***P. auroginosa***
8.75%	7	26.25%	21	***K. pneumomia***
13.75%	11	8.75%	7	***S. aurous***
3.75%	3	1.25%	1	***S. haemolyticus***
1.25%	1	2.50%	2	***Proteus***
1.25%	1	1.25%	1	***A. baummnni***
0.00%	0	1.25%	1	***E. faecalis***
100.00%	80	100.00%	80	**Total**

The results indicated that the most common bacterial isolates were Gram-negative bacteria, specifically *Escherichia coli which* was responsible for 30% of isolates before dialysis treatment, rising to 35% afterwards. This type is one of the most common causative agents of urinary tract infection in general, and this is consistent with a study (Flores-Mireles et al., 2015), which showed that more than 75% of urinary tract infections are caused by E. coli, especially in immunocompromised patients such as kidney patients.

Pseudomonas aeruginosa was also high (28.75% before and 36.25% after), a resistant and moist environment-loving bacterium such as scrubbers and catheters, and a common source of hospital-acquired infections (Bassetti et al., 2021). Their high percentage after washing may indicate the possibility of contamination during the procedure or a weakening of the immune system after washing.

Klebsiella pneumonia was clearly visible before washing (26.25%), but decreased significantly after washing to 8.75%, which may indicate that some isolates were eliminated or not recovered in the next sample, and may reflect a temporary change in the urinary environment due to the effects of dialysis.

Staphylococcus aureus appeared at 8.75% before washing and increased to 13.75% afterward, suggesting that it may be among the skin germs transmitted through tube or catheter handling, especially in immunocompromised patients (Tong et al., 2015).

Staphylococcus haemolyticus, Proteus spp. , Acinetobacter baumannii, and Enterococcus faecalis have appeared in small proportions, but their presence is clinically significant, as they are resistant isolates and have the ability to survive in partially sterile environments.

Epidemiologically, the results of this study are consistent with the findings of a study (Al-Qahtani et al., 2020) in Saudi Arabia, which showed that the majority of urinary isolates in dialysis units were *E. coli and P. aeruginosa*, followed by *Klebsiella and Staphylococcus*.

In contrast, studies (Huang et al., 2019) have shown that *Staphylococcus aureus* is the most common bacteria in catheter and dialysis patients, especially in advanced cases, suggesting that the bacterial infection pattern may be associated with environmental factors, hygiene level, and healthcare practices.

Conclusions

Gram-negative bacteria, particularly *Escherichia coli and Pseudomonas aeruginosa*, accounted for the highest proportion of bacterial isolates in urine samples before and after dialysis sessions, indicating that these types are primary pathogens in this group of patients.

A change in the pattern of spread of some bacteria was observed after the dialysis session, as the percentage of *P. aeruginosa* and S. aureus isolates increased after washing, indicating the possibility of contamination or weakened immunity acquired after the session.

he results reflect the need to apply stricter preventive measures in dialysis units to reduce the transmission of pathogens, especially infections acquired during therapeutic procedures.

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